The Citrus Industry

AUG 8 1950

New Faces - Same Policy - We Hope

There are new faces in both the Florida Citrus Commission and Florida Citrus Mutual, but—we hope—no change of policy in these two great Florida Citrus organizations.

The new men appointed and elected to positions of directorship in both organizations are well known to Florida citrus growers, men of long standing in the industry; men of real worth whose devotion to the welfare of the industry is unquestioned and whose continued service to the industry is to be expected

Both the Florida Citrus Commission and Florida Citrus mutual have a great responsibility to Florida citrus growers—a responsibility which in the past has been carried out with vigor and integrity. There is every reason to expect that they will continue to serve the industry with that same singleness of purpose and devotion to the interests of the growers.

Cooperation between the two bodies is of the utmost interest to every phase of the industry. It is to be expected that men of the fine calibre of those in responsible positions in the two bodies will see that such cooperation exists and that the welfare of the industry as a whole is the paramount objective of all members. We believe that growers may look forward with confidence to such cooperative effort on the part of both organizations.

JEFFERSON THOMAS
AGRL. EXPER. VENT STATION

Vol. 31, No. 7 July, 1950

Summer Time Is Growing Time

Citrus trees normally put on new growth during this period and provide nourishment to the crop which has been set. The functions of a proper fertilization program are to provide trees with all the health-giving and strength-building nourishment possible, in order that the trees may produce big crops and crops of fine quality fruit and so that they may be strong enough to resist the ravages of pests and weather which may attack them.

Florida Favorite Fertilizers over a period of many years have proven their helpfulness in promoting such a program, with the result that growers all over the citrus belt will vouch for the effectiveness of our fertilizers and our fertilization program.

We invite every citrus grower to thoroughly investigate the proven records of achievement which have been attained through the use of our fertilizers and to compare results.

Our staff of Field Service Men are eminently qualified to offer counsel and advice to Florida growers and will gladly do so without obligation on your part.

Then, too, we suggest that our delivery system carried on by means of our own fleet of trucks has proven throughout the years to be of exceptional advantage to all of our customers.

Florida **Favorite**

FERTILIZER, INC.

Old Tampa Road **Lakeland, Florida**

Sprays For Citrus For July 1950

CITRUS EXPERIMENT STATION,
LAKE ALFRED, FLA.
JAMES T. GRIFFITHS AND
W. L. THOMPSON

The advent of the 4th of July will find citrus growers in the midst of their scale control programs for 1950. Most programs are already well planned and are in the process of execution; however, there are some factors which should still be noted by individual growers which may be of some importance to them in their spray schedule. Both purple scale and Florida red scale passed peaks of egg laying activity during the last two weeks in June. This means that the first two weeks in July will be especially advantageous for killing both species of scale. Other factors being equal it would be preferable to spray before the 15th of the month rather than after that date. Where spray operations will continue up until August 1st, it is desirable that sprays for red scale control avoid the period of 10 days around August 1. Red scale will again be laying eggs approximately at that time.

If oil sprays are being used growers are again reminded that sprays applied after about the 20th of July may affect solids and color adversely. If possible apply oil sprays prior to that date. This is especially important on fruit which is to be moved early in the season.

Where parathion is being used one additional precaution should be added to those which are already laid down. Where it is possible spray hands and workers handling parathion should be rotated so no individual man will have an exposure exceeding 6 days without several days away from the material. It is believed that this measure will be helpful in avoiding illnesses which have resulted in some cases. Precautions should not be relaxed. Evidence which has been collected clearly shows that the relaxation of precaution by individual workers or by groups of workers has resulted in undue numbers of illnesses in particular spray operations. Parathion may be used safely on into August and September so that where parathion is being used it is not essential to rush the spray job and try to finish spraying by the latter part of July. Where scale infestations are rather light the application of parathion may be held up for another month, six weeks or even longer if desired.

The black scale, **Saissetia oleae** (Bernard), a species of scale usually of no importance on citrus in Florida has been found in a number of groves in Highlands and Polk counties within the past month. Regardless of spray programs, light to heavy infestations have been found in groves inspected to date. One of the symptoms of an infestation is sooty mold. However mealybugs, whiteflies and aphids also secrete honeydew but if there is, at the present time, a noticeable amount of sooty mold on the leaves it would be well to inspect the young wood, especially the fruit stems, for black scale.

The adult female is dark brown to black, nearly circular and has two transverse ridges and one longitudinal ridge on the back which form the letter "H". When the living adult female is turned over the inside of the "capsule" is full of pinkish colored eggs or a mixture of eggs and crawlers.

The first stage of the scale is flat and somewhat oval with a brown colored ridge along the back. The second stage of the scale is similar to the first stage except for the increase in size and as the scale reaches maturity the ridges become more apparent.

Since the black scale has never been a problem in Florida no specific data in this state are at hand for its control other than an oil emulsion application at the same concentrations used for the control of purple and Florida red scale. The application should be made when a high percentage of the scales are in the first stage and early second stage. Second stage scales that are almost mature are difficult to kill. The control will not be satisfactory if the oil application is made when the adults are depositing eggs because the oil does not come in contact with the eggs and crawlers inside the scale capsule.

Parathion has not been tested for the control of black scale. However, parathion has not been effective for controlling the soft brown scale which is more or less the same type of scale as the black scale.

Rust mites have come up in considerable numbers in many groves during the month of June and sulfur will be applied for their control during July. The question of using lime sulfur always arises at this time of year. Lime sulfur should not be used on early and mid-season varieties of oranges. These include such varieties as Hamlins, Parson Brown, Pineapples, etc. If it is to be used on grapefruit or Valencias the gallonage should be reduced to a minimum at this time of year. A thorough application of wettable sulfur may yield the same results as using lime sulfur.

For more specific information consult the University of Florida Citrus Experiment Stations at Fort Pierce or Lake Alfred.

USDA EXTENDS ORANGE EXPORT PROGRAM

The Production and Marketing Administration of the U. S. Department of Agriculture has announced extensions of the periods for making sales, filing Notices of Intention, and exporting fresh and processed oranges under the orange export program to September 15, September 17, and September 30, respectively. Program termination dates as originally established were June 15, 17, and 25, respectively.

Also, Singapore and The Federation of Malaya have been added to the list of eligible destinations under this program.

During this hot weather, eggs should be gathered no less than twice and preferably three times per day and stored in the coolest possible place until they can be marketed.

Foods and Fertilizer...

FIRMAN E. BEAR
IN FERTILIZER REVIEW

The fertilizer industry represents the most important advance ever made toward providing plenty of food for the peoples of the earth. By the use of fertilizers, it is possible to bring the most barren ground into production, to maintain the productivity of fertile soils, and to raise the crop-producing capacities of all soils to higher levels. Without their use, the problem of adequately meeting the food needs of the world's 2 billion people is essentially insolvable.

The raw materials that go into the production of fertilizer had their orgin largely in the face of the earth. As the rock underwent the action of the elements over the ages it lost a large part of its substance to the sea. It is the job of the fertilizer and the agricultural lime industries to return these leached-out materials to the land from which they came. The fertilizer industry, in addition, collects nitrogen from the inexhaustible supply in air and combines it with other elements so it can be used on the soil.

The earth came into existence some 2 billion years ago. A billion years passed before even the simplest forms of life came into being, and it took another 700 million years for flowering plants to evolve. The primitive forms of man did not arrive on the scene until a mere million years ago.

During the 2 billion years of the earth's existence, gigantic forces were at work tearing the rock to pieces, leaching out the soluble salts, carrying them out to sea, and laying them on the bottom of the oceans. In addition, atmospheric nitrogen was being combined with carbon, hydrogen and oxygen on a tremendous scale to form organic matter.

Much of what took place during this long expanse of time might appear to have been extremely wasteful. But there was method in Nature's madnes.s The salts in the sea were not wasted. They merely awaited the hand of God and man. In due time, large deposits of these rock-derived materials were shoved up out of the ocean, and they are now being put back on the land from which they came. Among them are many billions of tons of phosphate rock, potash salts, nitrate of soda, limestone, sulfur and borax.

Everything on the earth, in the sea, and in the air above us has been placed at man's disposal. He has been endowed with a brain with which to think. Out of such thinking has grown an enormous chemical industry. The fertilizer and lime producers constitute a highly important part of this industry. During 1949, some 45 million tons of material were processed and applied to the land, the United states alone. The necessary raw products were gathered from ancient seas, from the deserts, and from the air. And, when these products had been properly processed and applied to the land, the results on the crops were nothing less than phenomenal. Poor land was made good, good land was made better, and even the best land responded to their magic touch.

Why are these chemicals so effective? Merely because they add to the supply of essential plant-nutrient elements in the soil. This was one of the earliest discoveries of the agricultural chemists who began work on this problem about 150 years ago. These chemists analyzed plants, the gases that escaped when they were burned, and the ash that remained. They analyzed the soils on which the plants had been grown, the manure that was applied to the land, the water that carried the necessary elements into the plants from the soil, and the air that was above and in the soil. Out of the facts assembled by these procedures, a complete picture was formulated of what plants require. It was shown that in proportion as any given soil was low or lacking in any given essential element more of that element could be added to advantage. Out of these findings grew the fertilizer industry.

That is what one should expect. The most fertile lands on earth are the irrigated deserts. All that is needed in the desert to produce luxuriant yields of the finest quality food crops is to supply the missing water. Irrigated desert lands contain all the elements of fertility in abundance. All they need to become highly productive is that water be added through which these elements can move into the plant. Such land can be farmed for a half century before any serious reduction in yield takes place. In due time, of course, extra nitrogen and phosphorus have to be applied and, after a century or so, some of the other fertility elements as well. In general, however, irrigated-desert soils are highly productive because the salts that have been dissolved out of the rocks from which they were derived were not carried away by heavy rains. These salts are the same kind as those that are hauled back and put on the land as fertilizers in the humid areas of this country.

Some of the most productive land on earth has been reclaimed from the ocean. A notable example of such reclamation is found in Holland. There a dike was built across an arm of the sea, the ocean water was pumped out, and the soil was gradually brought under cultivation. The yields on this land are exceptionally high, merely because the soil is saturated with sea salts. And the quality of these crops, like that of the crops grown on the irrigated arid areas of the earth, has never been questioned.

It has long been known that the physical properties of soils are equally as important as their chemical makeup in determining their productivity. In some areas, no special physical problem is involved because the soils are made up of almost ideal proportions of sand, silt and clay. But, for most soils, two important procedures are essential if it is to be maintained in good physical state. It must be well supplied with organic matter, and, following each period of cultivation, it must be given time to undergo a healing process.

There is no substitute for organic matter. When worked over by soil microbes, built into the structure of the fungi that grow through the soil, and reduced to the colloidal state, it becomes an intimate part of the soil, and when this has been done, the soil takes on highly improved physical properties as a result of which it becomes much more favorable for the growth of plant roots. But continued cultivation results in rapid loss of soil-organic matter. To overcome this loss and restore the granules, it is

Continued on Page 17)

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Representing no special interest

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Nucellar Seedling Strains of Citrus . . .

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RIVERSIDE, CAL.,
AT MEETING FLORIDA STATE
HORTICULTURAL SOCIETY

You have asked us to prepare a paper for your program which will summarize our present thinking as to the value of nucellar seedling strains of citrus. The practical value of such strains as a means of rejuvenating some of the older varieties has been of especial interest to investigators and commercial fruit growers.

Perhaps we should first explain what nucellar seedlings are. In the reproduction of most **Citrus** species by seed, several seedlings may be produced from a single seed. One of these may be a gametic seedling produced by the ordinary sexual process. The others are produced from cells of the seed parent outside the actual egg cell. These cells are known as the nucellus and seedlings arising from them are called "nucellar seedlings." These extra embryos which develop into nucellar seedlings are in some degree comparable to adventitious buds which push out from twigs and branches of trees.

In reviewing practical value of nucellar strains of citrus we do not feel called upon to prove or disprove the theory that there is a general senescence of horticultural crops which are propagated by budding, grafting, and other comparable means. Many papers have been written on this subject, and possibly a part of the explanation for their not being in agreement, is their consideration of a wide variety of plant material grown under diverse conditions. Nucellar seedlings, however, have one outstanding characteristic which makes them of value as a means of rejuvenating citrus varieties.

So far as we know, all nucellar seedlings make an extremely vigorous and rapid growth. In any sort of a comparison one can make with budded progeny of a parent tree, seedlings or budded trees from the seedlings usually grow much faster than the parent stock. The nucellar strains, however, are much more thorny than the parent, produce flowers at least one or two years later, and generally come into full bearing much slower. Some of these juvenile tree characteristics are commonly observed in citrus nurseries among seedlings grown for rootstocks. Such nursery trees are largely nucellar; that is why they are so uniform and practically indentical with the parent tree.

A careful study of nucellar strains was made by Dr. Howard B. Frost (1938),[4] who concluded that there is considerable evidence that the tendency to bloom and set fruit increases as the thorniness decreases. He was able to reduce thorniness greatly in the progeny trees by selecting budwood as free as practical from thorns. Fig. 1, taken from Frost clearly demonstrates this, even though the buds were taken from a single unbranched water sprout about two yards long. Frost concluded: "The evidence here presented indicates that, in the propagation of promising new varieties, the reduction of thorniness can often be greatly promoted by selection of thornless budwood on trees which have grown about five to ten years in the orchard." The same investigator also concluded that seedling vigor is more persistent than seedling

1. Paper no. 000, University of California Citrus Experiment Station.
2. Director, University of California Citrus Experiment Station.
3. Assistant Geneticist, University of California Citrus Experiment Station.
4. Frost, Howard B. 1938. Nucellar embryony and juvenile characters in clonal varieties of **Citrus**. Jour. Hered. 29:423-432. 3 figs.

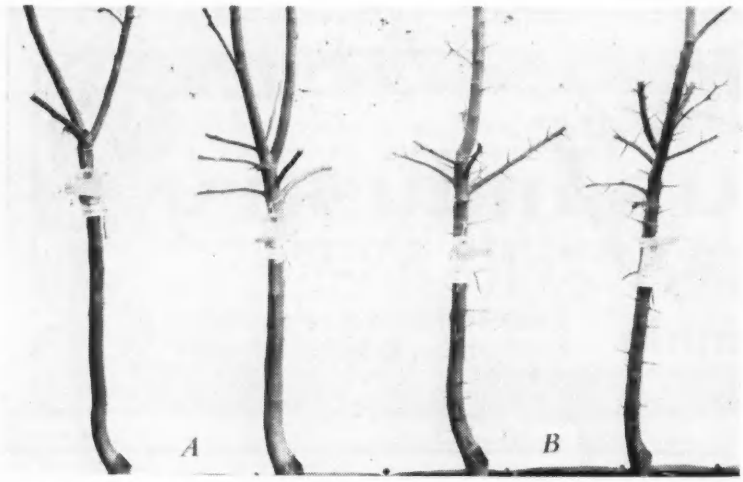

Fig. 1. Young trees, all budded from one unbranched erect shoot. A—Two trees from budwood taken near the middle of upper half of shoot, this half being almost completly thornless. B—Two trees from budwood taken near base of shoot and bearing thorns about 3 to 5 cm. long. (Photograph from Howard B. Frost, 1938.)

thorniness. This has an important bearing on the practical value of any nucellar strains.

The fruit characteristics of the nucellar strains, or as Frost called them, the "young clones" are important. In this regard Frost (1938) wrote as follows: "The fruits of young clones seem to have a fairly general tendency to greater elongation, greater firmness and ragginess of pulp, and earlier onset of over-ripeness changes, including core hollowness, rind puffing, and pulp granulation and drying." These unfavorable fruit characteristics should not be overlooked by anyone who is considering the planting of nucellar strains even as a limited experiment. Frost's observations have been confirmed by those made subsequently at Riverside. These unfavorable fruit characteristics, however, are much more evident with oranges and grapefruit than with lemons. Lemons are picked acording to size, and in a rather immature state, and then cured. They thus escape some of the characteristics of aging to which oranges and grapefruit are subject.

Several observers have noted that the fruit of the young clones generally has fewer seeds in it than the old strains from which they have originated. This continues to be indicated in data obtained during the last two years even from our oldest nucellar strains.

The percentage of total solids in the fruit of the nucellar strains of Valencia and Washington Navel oranges has been determined periodically during the past two years. In a dozen or more comparisons with the parent strains there has been no significant difference in the total solids. Comparable observations with the Satsuma orange have consistently shown that the nucellar strains were higher than the parent strains in total solids. The percentages in 1948 and 1949 were approximately 12.4:11.4 and 14.0:12.6, respectively, in such comparisons.

Perhaps we should explain now why we are interested in these nucellar citrus strains. There are

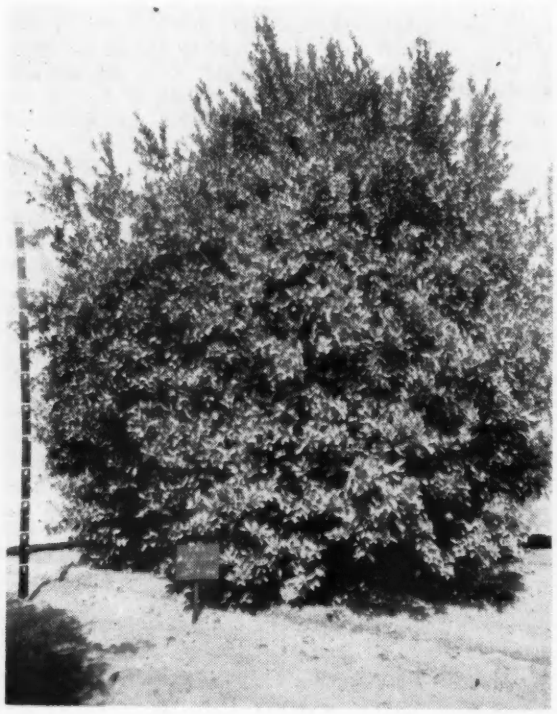

Fig. 2. Frost Eureka lemon tree, nucellar strain, sixteen years old. Compare this with the old clone tree in Fig. 3.

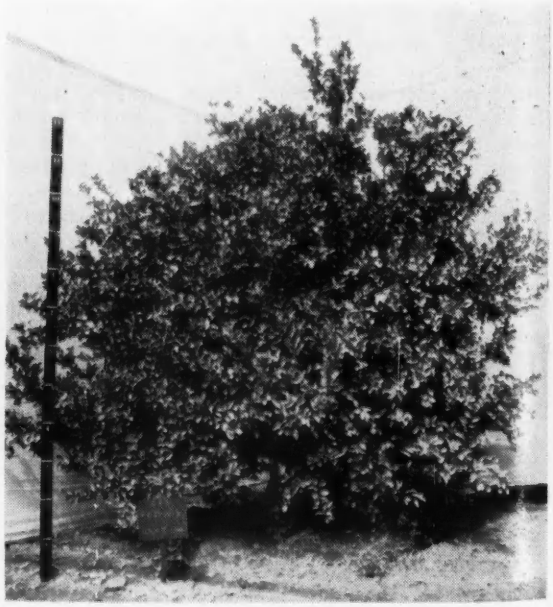

Fig. 3. Eureka lemon tree, sixteen years old, old clone strain budded from seed parent of tree in Fig. 2.

several more or less distinct reasons, one or more of which are frequently applicable to individual cases. Of especial importance in California is the reinvigoration of the Eureka lemon variety by progation from a nucellar seedling.

The Eureka is the most popular and best quality fruit of all lemon varieites grown in the state. The tree characteristics are not so favorable. The trees have only moderate vigor, have a tendency to excessive bearing followed by outbreaks of "shell bark" on the trunks, and often reach such a state of deterioration that a grove is unprofitable by the time the trees are fifteen years old. The nucellar strains seem to have enough added vigor to resist these diseases and are very promising at the present time. Fortunately this advantage is gained without sacrificing fruit quality or yield.

The contrast between the Frost Eureka, a nucellar strain, and the old parent strain of Eureka from which it is descended is shown in Figs. 2 and 3. Both trees are on sweet orange rootstock and are sixteen years old. The Frost Eureka is the second budded generation from the original seedling which was produced in 1917. The Frost is entirely free from the physiological disease called shell bark in California, whereas the old clone tree is badly affected. There has been more contrast in the size of these trees during the past five years than there was formerly. We think this is due in some measure to inroads of shell bark on the old strain. The yields of these two trees have been in direct proportion to their size for approximately the past ten years.

A typical tree of the third budded generation of Frost Eureka is shown in Fig. 4 with the parent strain for comparison in Fig 5. Ten trees of each sort on sour orange rootstock are growing in adjacent rows in our experimental plot. Shell bark symptoms have not appeared on any of the trees; nevertheless, the nucellar trees of this third budded generation are markedly larger than those of the parent strain. This added vigor of the nucellar strain of Eureka lemon has been of great interest to lemon producers in California and has justified their propagating more than one hundred thousand Frost Eureka trees during the past two years. These have been widely planted throughout the lemon-growing areas of the State. Other selected strains of the original Eureka are being compared with the Frost Eureka.

Another example of conspicuous reinvigoration is the case of two nucellar strains of Owari satsuma produced by Dr. Howard B. Frost. Each shows much larger tree size than the parent strain of the same age. Over the last eight-year period the trees of the second budded generation of the nucellar Owari have yielded nearly twice as much fruit as the parent strain, and the fruit has colored earlier. The nucellar strain is now thirty-two years removed from the seedling parent.

Another reason for interest in more vigorous trees in general is our difficulty in California in making replants grow satisfactorily in old orchards. We used to think this was due primarily to competition with the old trees. We now are convinced that there are other factors operative in such cases. In any event, there have been so many practical failures in establishing replants that some orchardists are willing to acept all risk of undesirable characteristics of nucellar strains and to try them almost as a last resort.

In many instances in California, planting land to citrus a second time has proved a practical failure, even though the soil was well adapted to the original orchard. This applies to oranges as well as lemons. The trees of such second plantings have made a very poor growth. At a given age they have produced about half a crop compared with the original orchard at the same age. At present we are engaged in an extensive investigation to determine the causes of this trouble. The growing of other crops for four or more years followed by fumigation of the soil apparently does not entirely overcome the difficulty. Orchardists are therefore trying a few trees

Fig. 4. Frost Eureka lemon tree, nucellar strain, eight years old; budded from tree shown in Fig. 2.

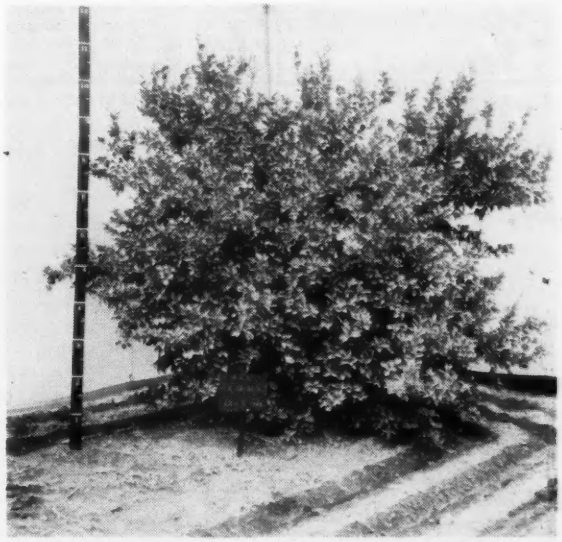

Fig. 5. Eureka lemon tree, old clone strain, eight years old; budded from tree shown in Fig. 3.

of these vigorous nucellar strains in the second planting. The possible practical value of this procedure with oranges and grapefruit is still in doubt. With lemons, the results are very encouraging.

The typical contrast between a group of the first budded generation of nucellar Campbell Valencia trees and trees of the old original strain is illustrated in Figs. 6 and 7. So far as the late Dr. Howard S. Fawcett could determine the original strain is free from any virus disease and is above average in size and vigor for the Valencia. Both the old and the new clone trees are budded on sweet orange rootstock and are now seven years old. The several nucellar strain trees have blossomed very little and have produced an exceedingly small amount of fruit whereas the old clone has been normally productive. We have in the same orchard another nucellar strain of Valencia which is the third budded generation from the seedling tree and thirty-two years removed from its parent. In this case however, the young clone is producing almost exactly the same amount of fruit as the old clone. The trees in the nucellar strain are more vigorous and produce somewhat larger fruit and are certainly more promising for an ultimately successful orchard. Several of these nucellar strains with such abnormal vigor are worth testing on old citrus land where ordinary strains have been a partial failure.

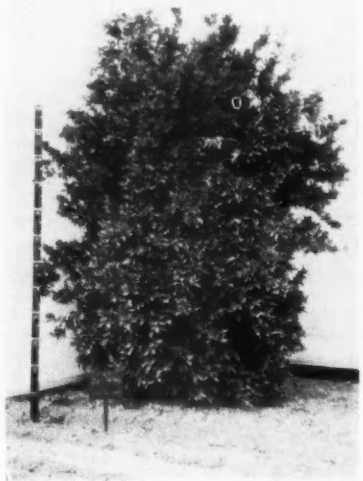

Fig. 6. Campbell Valencia orange tree, nucellar strain; first budded generation, seven years old. Compare with Fig. 7.

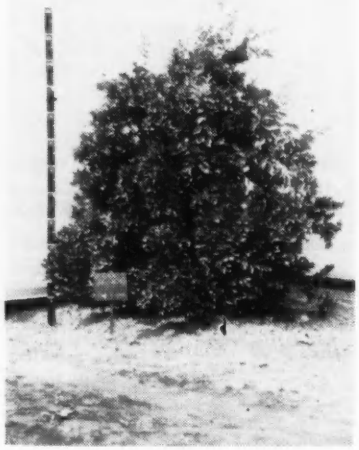

Fig. 7. Campbell Valencia orange tree, old clone strain, seven years old. Compare with Fig. 6.

Another characteristic of the nucellar strains which we hope will be of value in California is that they often produce larger fruit than the old clones. The small fruit size in California, especially with Valencia oranges, is a very important problem. It is indeed a complex one with many factors in the equation. The vigorous nucellar strains are being tried in a limited commercial way as a partial remedy for this serious situation.

The fact that passing a variety through the nucellar seedling stage

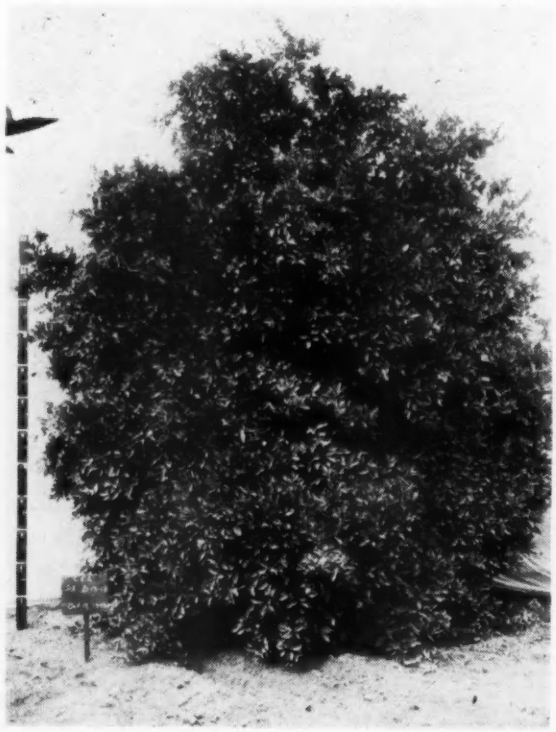

Fig. 8. Frost Valencia orange tree, nucellar strain, sixteen years old. Compare with Fig. 9.

Fig. 9. Valencia orange tree, old clone strain, sixteen years old; psorosis symptoms evident in the foliage. Compare with Fig. 8.

screens out virus diseases is perhaps the most important reason for our being interested in this procedure. Even though a virus disease such as psorosis has existed in the parent tree the seedlings are free from it. We are indebted to the late Dr. Howard S. Fawcett for many observations made on this point. His unpublished notes and a limited number of published articles show that a case of the transmission of the virus disease psorosis from the seed parent to the nucellar seedling is parctically nonexistent. Some investigators have believed that possibly one of the reasons for the nucellar strains' having so much more vigor than the parents was this factor of "screening out" such diseases as psorosis ,and possibly other virus diseases which are not now detectable. Fig 8 and 9 show trees from Frost's experiments which illustrate this very clearly. Fig. 8 shows a sixteen-year-old Frost nucellar Valencia tree free from psorosis. This is the second budded generation and is thirty-two years removed from the seedling tree. Fig 9 is an old clone tree of the same age with psorosis symptoms in the foliage. These trees now yield in direct proportion to their size.

The importance of using nucellar seedlings in rejuvenating, in fact salvaging, some valuable variety of citrus which has been rather generally infected with psorosis or other virus diseases can hardly be overestimated. As an example, we are informed that the Ruby grapefruit has become very generally infected with psorosis. This could easily happen when old trees are topworked with a new variety and the new tops used as a source of budwood. Only a small percentage of old psorosis-affected trees could quite generally infect the next generation of trees. Passing the variety through the nucellar seedling stage to screen out the virus and then rebudding in a few years from as nearly thornless wood as possible becomes a practical and valuable procedure. Without this method of salvaging, such a variety might otherwise become relatively valueless.

In the case of the Eureka lemon we are not aware that any virus disease is involved. Yet, the rejuvenated Frost Eureka, free from the physiological shell bark, is literally salvaging the Eureka variety.

The reinvigoration of the trees even in the absence of any virus indicates that the added vigor in nucellar strains is due in part to factors other than freedom from virus diseases. This is clearly shown also in the case of the Valencias illustrated in Figs. 6 and 7. Much research work has to be done to find out what these factors are. Probably there are several which contribute to these changes, and research work with viruses, hormones, and plant proteins will need to be carried out by chemists and plant physiologists before we fully understand this problem.

One more phase of the practical use of nucellar strains of citrus with which we are naturally concerned is the probable length of time that desirable characteristics such as vigor will persist within a single budded generation. Also, throughout how many budded generations should we expect them to persist? Our past experience has some bearing on the first question. Our oldest nucellar strains such as the Eureka lemon, are now thirty-two years of age and two budded generations removed from the original nucellar seedling. The great difference in vigor between the nucellar strain and the old parent strain has not decreased as time has gone on. It is clear, however, that our experiments are not old enough to really answer this question. The second part of the problem is also being investigated and we now have second, third, fourth, and fifth budded generations from the nucellar seedling growing in our orchards beside comparable budded generations coming down from the old Eureka strain. Even in this fifth generation we could see the difference in vigor in the nursery when the trees were one year old. We are now about to bud the sixth generation and plan to continue these studies several decades. At present, there is no clear-cut evidence of the old clone and new clone gradually approaching each other in vigor. Theoretically, we should expect them ultimately to do so.

In closing we might add that a general evaluation of nucellar strains of citrus varieties seems to us to be stimulating and valuable for the investigator and the practical orchardist alike. Both should try out, and closely observe nucellar strains in a constructive way, but make only limited use of them at present until more experience is gained.

The authors wish to express their appreciation to Dr. E. R. Parker, and Dr. W. P. Bitters for obtaining the illustrative material for this paper.

Sound waves of very high frequency are being studied for use in cleaning machinery and clothes, killing insects and sterilizing food. The U. S. Department of Agriculture has an ultrasonics laboratory at Beltsville.

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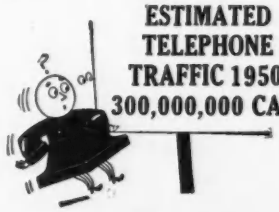

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Present Status of Organic Versus Inorganic Nitrogen As Related To Yield And Fruit Quality . . .

J. W. SITES
CITRUS EXPERIMENT STATION,
LAKE ALFRED, FLA.,
AT MEETING OF FLORIDA STATE
HORTICULTURAL SOCIETY

INTRODUCTION

The success of any fertilizer program is dependent upon the nutrient requirements of the crop, and upon the nature and characteristics of the soil on which it grows. If our citrus soils contained large reserves of the needed nutrient elements, citrus could be grown without the use of commercial fertilizer until the time when the supply of some particular element became exhausted in the soil and consequently became a limiting factor in the growth of the plants. Thus it is evident that the amounts and kinds of nutrients, and the form in which they are supplied by a fertilizer program are determined largely by the crop response which results from their application.

In the early period of the development of the citrus industry in Florida the fertilizer program was not complicated by the need for supplying adequate amounts of magnesium, copper, zinc and manganese as it is today. Plantings at that time were limited largely to "hammock" soils, or to well drained heavier "flatwoods" soils which largely contained adequate supplies of the nutrients needed for the growth of citrus, and such fertilizers as were used were supplied as organics. These soils, although desirbale from the standpoint of natural fertility, were usually so situated that groves suffered heavily from cold damage. As the industry developed and expanded, the increase in new plantings was extended to the light sandy soils in the State, which because of their better air drainage gave groves increased cold protection. This situation combined with the use of rough lemon root-stock which appeared to be so well adapted to these light sandy soils seemed to assure successful citrus production under these new conditions (1). The series of events which followed, however, proved this to be an optimistic viewpoint, for although these soils were desirable in providing needed cold protection they were extremely low in natural fertility (2). Approximately coincident with the time these new plantings were coming into production there developed a trend away from the organic fertilizers previously used in favor of less expensive inorganic fertilizer salts. These materials were relatively pure and contained little magnesium, copper, zinc or manganese all of which elements were present in the organics as sizable impurities. As a consequence of these changes there followed the gradual decrease in production and the general widespread occurrence of deficiencies of magnesium, copper, zinc and manganese which were so familiar to all those intimately engaged in growing citrus in Florida in the 1920's and 30's (1). This rather brief historical outline is presented primarily to illustrate that it was not a question of whether nitrogen as such was supplied in an organic or an inorganic form which helped to precipitate the critical situation of the late 20's and early 30's. This condition was in reality, due to deficiencies of magnesium, copper, zinc and manganese which developed when these elements were no longer supplied as impurities in the fertilizers where inorganic sources of nitrogen and phosphoric acid were used. Inorganic nitrogen was relatively cheap, but its recommended use at that time was false economy and eventually cost the citrus growers of the State thousands of dollars. A fertilizer program that does not maintain production is poor economy even though it may be cheaper in dollars. This paper may be considered a progress report on the present status of organic versus inorganic nitrogen sources, it cannot be considered final, but the results indicate definite trends.

RESULTS

The results presented represent a portion of the data collected from Blocks IX and XI at the Citrus Experiemnt Station. The former is a fertilizer experiment involving Duncan and Marsh grapefruit varieties while the latter is a nitrogen source experiment conducted in a block of Hamlin oranges. The nutritional program followed in the grapefruit block is presented in Table 1 and that for the Hamlin orange block in Table 2. All other treatments of the plots being compared have been identical and in keeping with accepted grove management practices.

Internal Quality.—The internal quality, as characterized by the soluble solids, titratable acid and vitamin C content of the juice has been shown to be highly correlated with nutritional treatments for citrus. This relationship has been most pronounced between comparisons of deficiency conditions as contrasted to those where the deficient element has been supplied, but juice characteristics may also be considered a fairly reliable index of the efficiency of citrus nutrition where deficiencies are not involved.

The results of juice analyses of Duncan and Marsh grapefruit produced under 40 percent organic and inorganic nitrogen source fertilizer programs are shown in Tables 3 and 4. In order to conserve space only data for the past four years are presented but these years cover a fairly wide range of weather conditions. All data presented represent seasonal average values for each of the years in question. These averages are based on the results of from 5 to 10 sampling dates during the period from Sep-

Table 1.
Nutritional Program—Block IX—Marsh and Duncan Grapefruit.*

Source of Nitrogen	Plot Nos.	Fertilizer Analysis — Percentage						Dormant Nutritional Spray Lbs./100 Gals.		
		N	P205	K20	Mg0	Mn0	Cuo	ZnSO4	MnSO4	CuSO4
					1940 - 1943					
100% Inorganic	3 & 10	3	6	8	2	1	1	3	3	3
40% Organic	1 & 12	3	6	8	2	1	1	3	3	3
					1944 - 1948					
100% Inorganic	4 & 9	3	6	8	4	1	1	3	3	—
40% Organic	1 & 12	3	6	8	4	1	1	3	3	—

* Fertilizer applied Feb., June and Oct. at the rate of 15 lbs. per tree from 1940-45 and 20 lbs. per tree 1946-48. Lime is supplied so as to maintain an average soil pH of about 5.7. All plots received a neutral copper melanose spray.

tember to February of each year so that the average values include samples taken both before and after the time that legal maturity was attained. These values have been found to be the best index of quality as single samples are more subject to reflect differences due to sampling errors. These values should not be associated with any specific date of sampling since they represent the average of all the dates for any given year. The soluble solids content of the Duncan grapefruit juice was generally higher where a completely inorganic fertilizer program was followed, except for the 1948-49 season, when there was no appreciable difference. These differences were not large, the average difference amounting to only about 0.25 of one Brix unit over the four year period. The citric acid content was also slightly higher on the average each year but this difference was not significant. No significant differences were found in the juice content, soluble solids, titratable acid ratio, or vitamin C content.

Comparison and analysis of the Marsh grapefruit data showed that no consistent or significant differences in composition of the juice were affected by these treatments.

Analyses of the juice data for Hamlin oranges are reported as seasonal averages for each treatment in Table 5. These average values include samples taken both before and after the period when fruit would pass the legal maturity standards, but the majority of the samples were taken before fruit was legally mature so that the time of passing the maturity standards each year for the block as a whole could be ascertained. These values should not be associated with any specific sampling date, they are used here since they reflect a truer indication of the effect of treatment and less difference due to sampling error than would be shown by samples collected on any single specific date. The highest soluble solids content was found in the juice of fruit from trees which received their nitrogen as ammonium sulfate. The lowest soluble solids content was found to be in the juice of fruit from trees which received all their nitrogen from the organic source, castor pomace. Differences between these two treatments were highly significant. The soluble solids values for the other treatments were intermediate between these two and were not

Table 2.
Nutritional Program—Block XI—Hamlin Oranges.*[1]

Source of Nitrogen	Plot No.	Fertilizer Analysis—Percentage					
		N	P205	K20	Mg0	Mn0	Cu0
Ammonium sulfate	3 & 8	4	6	8	4	1	½
Sodium nitrate	2 & 7	4	6	8	4	1	½
Castor pomace	4 & 9	4	6	8	4	1	½
⅓ Ammonium sulfate) ⅓ Sodium nitrage) ⅓ Castor pomace)	6	4	6	8	4	1	½

* All plots received 3 lbs./100 gals. ZnSO4, dormant spray and neutral copper melanose spray.

[1] Fertilizer applied Feb., June and Oct. at rates of 10 lbs. per tree 1944-45, 12 lbs. per tree 1946-47-48.

Table 3.
Internal Quality of Duncan Grapefruit as Affected by 40 Percent Organic and Inorganic Fertilizer Mixtures.*

Source of Nitrogen	Fruit Size	Mls. Juice per Fruit	% Soluble Solids	% Titratable Acid	Ratio	Mgs. Vit. C/ 100 Mls. Juice
			1945-46			
40% Organic	70	251	9.11	1.47	6.22	44.0
100% Inorganic	70	250	9.41	1.49	6.31	45.2
			1946-47			
40% Organic	64	220	8.72	1.29	6.83	42.6
100% Inorganic	64	217	8.94	1.34	6.83	41.6
			1947-48			
40% Organic	64	223	8.36	1.28	6.66	38.7
100% Inorganic	64	217	8.75	1.31	6.74	39.9
			1948-49			
40% Organic	64	240	9.63	1.52	6.34	37.5
100% Inorganic	64	228	9.60	1.53	6.31	40.5

* Values included in above table represent the average of 5 to 10 samples taken each season from September to February, and include samples taken before and after fruit had reached legal maturity; they are not to be associated with any specific sampling date.

significantly different from them. There was no significant difference between any of the treatments in the other juice components studied.

In sumarizing the effects of the treatments on internal quality it has been evident that there is a slight increase in quality in favor of the inorganic treatments with the exception of Marsh grapefruit. These differences are however not of sufficient magnitude to be of any practical commercial importance with the exception of the higher soluble solids content of the Hamlin juice from fruit taken from trees supplied with ammonium sulfate. Even in this instance the soluble solids were only significantly reduced where all of the nitrogen was derived from an organic source.

External Quality.—The effect of high organic and inorganic nitrogen fertilization on the percentages of fruit produced which would meet U. S. grade standards are shown in Tables 6 and 7. One of the points frequently cited in favor of high organic mixtures is the production of fruit of good texture, this is generally attributed to the slower and more uniform availability of nitrogen. Comparison of results from these plots failed to show any consistent advantage for either the inorganic or 40 percent organic treatments for Duncan or Marsh grapefruit, or for any of the sources of nitrogen which were supplied the Hamlin oranges in the production of fruit which would meet U. S. No. 1 standards, or in the size of the fruit produced.

Production.—The quantity of fruit produced by trees under a fertilizer program determines to a considerable extent its usefulness for commercial operations. A fair indication of the posibilities of any fertilizer schedule can be ascertained only from a study of production over a fairly long period of time, and certainly cannot be judged by the performance during a one or two year period. The production data summarized and presented in Table 8 shows the average pounds of fruit per tree produced by both Duncan and Marsh grapefruit varieties during the period from 1940-41 through 1948-49. Production figures for the year 1944-45 are omitted since the October hurricane of that year removed almost all of the fruit and production records for that year were not taken. In comparing the 40 percent organic and inorganic treatments, Plots 3 and 10 (inorganic) are used for comparison with Plots 1 and 12 (40 percent organic) during the period from 1940 to 1943 since these plots were receiving only two units of magnesium in the fertilizer during that period. Beginning with the 1944 season, magnesium was supplied in amounts equivalent to four units of MgO to Plots 1 and 12 and for this period, comparison is made with inorganic Plots 4 and 9 which also receive this quantity of magnesium.

Table 4.
Internal Quality of Marsh Grapefruit as Affected by 40 Percent Organic and Inorganic Fertilizer Mixtures.*

Source of Nitrogen	Size	Mls. Juice per Fruit	% Soluble Solids	% Titratable Acid	Ratio	Mgs. Vit. C/ 100 Mls. Juice
		1945-46				
40% Organic	70	227	8.60	1.39	6.14	41.4
100% Inorganic	70	231	8.48	1.38	6.15	40.8
		1946-47				
40% Organic	70	187	8.11	1.24	6.65	39.5
100% Inorganic	70	200	8.26	1.22	6.94	38.2
		1947-48				
40% Organic	70	186	7.60	1.26	6.10	33.6
100% Inorganic	70	189	7.78	1.27	6.23	34.3
		1948-49				
40% Organic	70	212	8.42	1.32	6.43	34.4
100% Inorganic	70	217	8.43	1.30	6.42	35.8

* Values included in above table represent the average of 5 to 10 samples taken each season from September to February, and include samples taken before and after fruit had reached legal maturity; they are not to be associated with any specific sampling date.

Table 5.
Internal Quality of Hamlin Oranges as Affected by the Source of Nitrogen.*

Source of Nitrogen	Size	Gals. Juice/Box	% Soluble Solids	% Titratable Acid	Ratio	Mgs. Vit. C/ 100 Mls. Juice
		1945-46				
Castor pomace	200	5.4	8.62	0.76	11.57	54.6
Ammonium sulfate	200	5.9	9.10	0.81	11.22	56.4
Sodium nitrate	200	5.8	8.75	0.80	10.87	57.5
⅓ each above sources	200	5.5	8.90	0.80	11.13	54.6
		1946-47				
Castor pomace	216	5.0	9.23	0.81	11.69	50.7
Ammonium sulfate	216	4.9	9.52	0.83	11.71	51.8
Sodium nitrate	216	4.9	9.48	0.80	12.06	54.0
⅓ each above sources	216	5.3	9.18	0.80	11.81	48.2
		1947-48				
Castor pomace	250	5.0	8.82	0.84	11.01	48.2
Ammonium sulfate	250	5.3	9.01	0.86	11.06	47.8
Sodium nitrate	250	5.1	8.79	0.86	10.83	43.1
⅓ each above sources	250	5.1	8.88	0.80	11.65	47.1
		1948-49				
Castor pomace	250	5.8	9.75	0.81	12.61	51.2
Ammonium sulfate	250	5.7	10.40	0.83	13.21	53.7
Sodium nitrate	250	5.6	10.25	0.81	13.47	54.6
⅓ each above sources	250	5.6	10.22	0.82	13.20	50.5

* Values included in the above table represent the average of 4 to 7 samples taken each season from September to February and include samples taken before and after fruit had reached legal maturity; they are not to be associated with any specific sampling date.

Comparison of these two varieties of grapefruit shows that the trees receiving the inorganic treatment have yielded larger crops than those on the 40 percent organic program. Comparing the 8 year average values for Duncan, the difference between the two programs shows an average increase in yield per tree of 145 pounds per year in favor of the inorganic treatment. Although this difference appears to be quite large, statistical analysis of the yield data shows it to be just short of significance. Failure to show significance was due to variation in yield between duplicate plots of the same treatment.

The yield of Marsh grapefruit produced under these programs shows the same trend as the Duncan, and is even more pronounced. The inorganic treatment yield was 207 pounds per tree higher over the eight year period than the organic treatment. Statistical analysis showed this difference to be highly significant.

Production data for Hamlin oranges as influenced by sources of nitrogen are presented in Table 9 for the five year period (1944 through 1948) in which the experiment has thus far been conducted. Trees receiving their nitrogen in the form of ammonium sulfate have to-date produced more fruit than has been produced by trees receiving any other single source of nitrogen in the experiment or from mixtures of the three sources. These trees over the five year period have averaged 580 pounds of fruit per tree per year as compared to 422 pounds of fruit for trees receiving all nitrogen from castor pomace. This difference of 138 pounds per tree per year is statistically significant. Differences in yield between trees receiving the castor pomace, sodium nitrate, and a mixture of the three sources were not significant. Further, there was no significant difference in yield between the ammonium sulfate treated trees and those which received nitrate of soda, or a mixture of the three sources, although only an additional five pounds per tree increase is required between the ammonium sulfate and the mixed source treatments to make it significant.

Considering all of the yield data it must be assumed that the trend at this time is strongly in the direction of increased yields from the inorganic sources of nitrogen.

(Continued on page 16)

Table 6.

External Quality of Duncan and Marsh Grapefruit as Affected by 40 Percent Organic and Inorganic Fertilizer Treatments.

Source of Nitrogen	Percentage of Fruit in U. S. Grades					
	Duncan			Marsh		
	U. S. No. 1	U. S. No. 2	U. S. No. 3	U. S. No. 1	U. S. No. 2	U. S. No. 3
	1945-46					
40% Organic	55.53	40.52	3.95	70.73	28.03	1.24
100% Inorganic	60.78	33.69	5.53	40.92	57.35	1.73
	1946-47					
40% Organic	42.61	48.03	9.36	43.95	45.00	11.05
100% Inorganic	60.78	33.69	5.53	38.86	49.72	11.42
	1947-48					
40% Organic	0.21	24.79	75.00	4.66	42.84	52.50
100% Inorganic	9.59	31.09	59.32	27.91	37.05	35.04
	1948-49					
40% Organic	76.72	16.92	6.36	46.96	47.17	5.87
100% Inorganic	66.99	27.01	6.00	47.85	44.62	7.53

Table 7.

External Quality of Hamlin Oranges as Affected by Source of Nitrogen.

Source of Nitrogen	Plot Nos.	Percentage of Fruit in U. S. Grades			Ave.
		U. S. No. 1	U. S. No. 2	U. S. No. 3	Diameter (Inches)
	1947-48 Season				
Castor pomace	4 & 9	42.7	39.8	17.5	2.97
Ammonium sulfate	3 & 8	49.5	34.3	16.2	2.97
Nitrate of soda	2 & 7	38.3	40.0	21.7	3.00
⅓ Castor pomace)	6				
⅓ Ammonium sulfate)	6	42.8	36.4	20.8	2.97
⅓ Nitrate of Soda)					
	1948-49 Season				
Castor pomace	4 & 9	62.5	35.6	1.9	2.89
Ammonium sulfate	3 & 8	60.2	36.9	2.9	2.81
Nitrate of soda	2 & 7	61.1	37.2	1.7	2.90
⅓ Castor pomace)	6				
⅓ Ammonium sulfate)	6	68.1	28.1	3.8	2.88
⅓ Nitrate of Soda)					

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Reports Of Our Field Men . . .

NORTH CENTRAL FLORIDA
V. E. (Val) Bourland

It continues dry in some sections while in ohter areas the scattered rains have been sufficient to keep grove properties in good shape. Scale insects have been playing havoc in some groves, even killing large wood, but growers are busy with oil sprays and are getting these pests under control in most cases. Rust mite has also been working extensively and here too growers have had a difficuly time in getting them under control. With most of the summer application of fertilizer applied to groves we are now looking at the crop in prospect for the next shipping season and we are glad to report that it is very good. Cover crops are looking good and have made good growth where we have had ample rains. Most all valencias and grapefruit have been picked, but a number of packing houses have closed down and others will do so very shortly.

SOUTH POLK, HIGHLANDS AND HARDEE COUNTIES
R. L. (Bob) Padgett

The most serious handicap that we have had to overcome this spring and summer has been the continued drought. All groves have suffered to some extent from the dry weather and many groves that have never been irrigated were given water at some time during the past few months. It continues dry and irrigation plants are in full operation. We have a fairly good crop of fruit set for the approaching season and while a fairly large percentage of this is late bloom it appears that it will be of good quality. This late bloom could be of some advantage in moving the fruit. The summer application of fertilizer has been applied and is now beginning to work in keeping fruit and trees in excellent condition. Scale insects were bad to start this season and there have been generous applications of oil made during the past month or two to bring this pest under control. The vegetable crop in this section was not up to expectations this year. Some growers made money while others had a loss, due mostly to unseasonable weather conditions.

POLK COUNTY
J. M. (Jim) Sample

Getting ample water to grove property has been a problem for several months. While we have had some rain we have not had enough, and growers have been forced to keep their irrigation plants going at full blast. At the present time it is getting awful dry in many sections, necessitating further irrigation. In spite of the dry weather we have a good crop of fruit set in most cases and while a large part of it may be late bloom it appears that we are going to have some real quality fruit. The summer application of fertilizer has been applied and groves are looking very good. Spray machines have been kept busy in an effort to keep scales and mites under control and from our observations it seems that they have done a very good job. Most of the fruit from this section has been moved and will be completely gone within the next week or two.

HILLSBOROUGH & PINELLAS COUNTIES
C. S. (Charlie) Little

With the exception of the extremely dry weather we have had a good season all over the territory. The drought has necessitated the spending of a great deal of money in keeping all irrigation plants going at full blast. However fruit prices have been good and with most of the growers wanting a good crop next year, all possible has been done to keep trees in good condition. We have made a normal application of fertilizer this summer and trees and cover crops are in good shape. We had a large acreage of watermelons planted this spring but the cold weather nipped these just as the vines started to run and as a result the production has been very limited, but some growers came through and received good money for their crop. Due to heavy scale infestations it has been necessary to use oil sprays on all groves and it might be possible that the second oil sprays will have to be used on some properties. The various mites have also done some damage, but now are pretty well under control.

WEST CENTRAL FLORIDA
E. A. (Mac) McCartney

With the many jobs to be done at this season of the year on a citrus grove, most men have considered it necessary to go forward with their summer application of fertilizer. They have done this and almost without exception have used standard brands with a complete range of secondaries. The citrus groves are in excellent condition and have set a good crop of fruit to be harvested durnig the next season. Prices have been fair to good and as a general rule growers have made some money above the cost of production. The use of oil sprays have been very general and their use continues at this time. Rust mite have been active but have been kept under control in a very satisfactory manner. The old crop of fruit has been moved and many packing houses are closed or will be during the next few days. There is a wide diversity of opinion about how the crop will be sold next year and there is a 100% hope that it will be as good as during the past season.

WEST FLORIDA
Eaves Allison

Weather conditions have not been too favorable this spring and summer for the production of citrus, vegetable or flower crops that are grown in the section. However, with the expert care that growers have given the crops we certainly cannot call the season a failure. While there were heavy losses in some cases there were other growers that hit the market just right with real quality produce and made a nice profit. Our summer application of fertilizer to citrus groves is just about over and as a general rule the trees and fruit are in very good shape. It now appears that we will have considerable acreage of new land cleared during the summer for fall vegetable planting. There were several watermelon growers in the Arcadia section that come through the ravages of weather and made good money on their melon crop.

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Durin' the past few weeks we've heard some discontented talk about the Florida Citrus Commission. Seems to us it is evident that this body has done an excellent job in the past and we hope that everything will soon be happy again in this group. The recent appointment of C. V. McClurg of Lakeland to this body certainly added prestige to the Commission as he is an able executive and a most capable business man. He is a citrus grower and banker and we know he will lend his abilities to complete cooperation in effectin' harmony among the group.

There ain't no question about the fact that we have had unusual weather conditions durin' the past few months and these conditions hain't helped citrus and vegetable production none. However, with the natural talent of citrus and vegetable growers we'll overcome our hard luck and work for a good season just ahead of us. Vegetable growers suffered either from too much rain or not enough, but in spite of it they did a swell job and kept fresh produce available for the consumin' public of the nation.

Fruit growers all over the state are workin' as hard as they know how to develop an excellent crop of fruit to market this fall and next spring. Practically all groves has been properly fertilized and the spray program is bein' carried out in more detail than we've ever seen before. This will add up to increased production and real quality fruit—the kind that will be in demand and will git top prices.

We are now windin' up our fiscal year and we want to thank each of our customers for their business and their good will. We hope that we may continue to serve you for many, many years to come and we'll keep right on doin' our best to give your the finest fertilizer at all times and to give you service second to none.

Durin' the summer growers will be able to do many jobs they hain't been able to get around to before. With extra labor available we'd like to suggest that every grower get everything done durin' this summer that will help his grove.

Uncle Bill

Table 8.
Production of Duncan and Marsh Grapefruit as Affected by Source of Nitrogen.

Source of Nitrogen	Plot Nos.	Ave. Yearly Production (Pounds per Tree)								Ave. Production Pounds per Tree
		1940-41	41-42	42-43	43-44	45-46	46-47	47-48	48-49	8 Year Period
					Duncan Grapefruit					
40% Organic	1 & 12	414	312	458	840	694	574	372	710	547
100% Inorganic	3 & 10* 4 & 9	788	190	927	762	933	786	452	703	692
					Marsh Grapefruit					
40% Organic	1 & 12	817	531	774	1015	1035	727	632	962	818
100% Inorganic	3 & 10* 4 & 9	948	862	1005	1199	1294	911	1240	698	1025

* Production for plots 3 & 10 from 1940-1943; plots 4 - 9 from 1944 - 1948.

PRESENT STATUS OF ORGANIC VERSUS INORGANIC NITROGEN

(Continued from page 13)

DISCUSSION

The difficult problem in any research study is not to obtain the data itself, but to know how and where to make application of it so that the greatest good may be acomplished. It does not necessarily follow that a broad and general recommendation for the use of inorganic nitrogen based on the results of these plots is to be advocated at this time. It should be made very clear that the straight inorganic mixtures as reported here have given satisfactory results only because adequate amounts of magnesium, copper, zinc and manganese were supplied, and that where these nutrients were not supplied to other trees in the same experimental block, those trees have gone out of production due to deficiencies, suffer severely from cold damage, and produce poor quality fruit. It is recognized that there are growers in the State who do not supply supplemental elements in recommended amounts, or who apply them irregularly or only after deficiency symptoms are apparent to some extent. Under these conditions high organic mixtures should be recommended in preference to inorganic mixtures since the supplemental elements contained in the organics would tend to forestall the occurrence of grove decline due to deficiencies.

The use of high organic mixtures as insurance against the possible occurrence of deficiencies not yet identified is another factor to be considered. There is less likelihood that a general, widespread, critical deficiency condition, such as occurred in the early 30's following adoption of inorganic programs will reoccur, since the plots at the Citrus Station which have been on inorganic programs for a number of years should show symptoms well in advance of commercial groves. With advance notice, such symptoms could be identified and corrective measures could be developed prior to its becoming a commercial problem.

All things are relative. While two decades ago it was wrong to use inorganic mixtures of nitrogen, phosphorus and potassium it does not necessarily follow that they may not be used to advantage today so long as they are supplmented with adequate amounts of the other required nutrients. It should be emphasized that such a program should be used only by growers who are willing to supply adequate amounts of magnesium, copper, zinc and manganese and who follow and observe carefully the performance of their grove. Only under these conditions, irrespective of the apparent advantages, does the use of a strictly inorganic nitrogen source fertilizer program appear to be tenable.

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POLK PACKING CO., PLANT DESTROYED

The packing plant of the Polk Packing Company at Eloise, one of the very largest plants of its kind in the state, was almost totally destroyed by fire, entailing a loss of approximately $2,500,000. Only the citrus concentrates unit was saved. President John A. Snively says that it has not yet been determined whether or not the plant will be reconstructed.

GRAPEFRUIT MATURITY CODE SOMEWHAT RELAXED

The Florida Citrus Commission has granted a slight relaxation of the Florida Citrus Code as regards the maturity test of grapefruit for the rest of the season. This relaxation will permit the shipment of grapefruit, much of which is sprouting seeds but still short of the maturity provisions of the citrus code. Unfortunately, the relaxation came too late in the season to benefit the major part of the crop, but growers with fruit still on the trees will be benefitted.

Table 9.
Production of Hamlin Oranges as Affected by Source of Nitrogen.

Source of Nitrogen	Plot Nos.	Ave. Yearly Production (Pounds per Tree)					Yearly Ave. Production per Tree for 5 Yr. Period
		1944-45	45-46	46-47	47-48	48-49	
Castor pomace	4 & 9	120	492	460	620	468	432
Sodium nitrate	2 & 7	238	584	523	582	448	475
Ammonium sulfate	3 & 8	279	685	615	760	510	570
⅓ Sodium nitrate) ⅓ Ammonium sulfate) ⅓ Castor pomace)	6	214	570	524	652	478	460

FOODS AND FERTILIZERS

(Continued from Page 4)

necessary to seed the land down regularly to some type of sod crop whose tops form an umbrella that stops the fall of the rain before it reaches the soil, while its roots aid in the regranulation process.

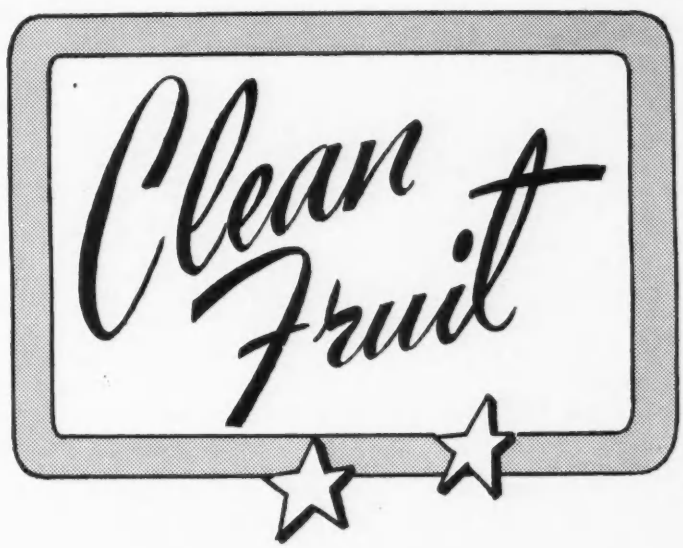
It is important to keep in mind that roots and roothairs are far superior to any other type of organic matter that can be added to the soil. In growing, the roots dry out the soil and aid in its granulation. On dying, they add fresh supplies of organic matter. As the roots and other crop residues are acted on by soil microbes, their organic substance becomes an intimate part of the soil. The only feasible method of quickly getting large amounts of organic matter down deeply into the subsoil is through the growth of deeprooted plants. In other words, it must be grown there.

It is at this point that fertilizers enter the picture in an especially important way. They stimulate not only much greater top growth of plants but much greater root growth as well. In proportion as the soil is well fertilized and limed, roots are abundant, they spread throughout the plow depth of soil, and they grow down deeply into the subsoil. Thus by applying purely inorganic amendments to the soil one can add greatly to its organic-matter content.

During a 15-year test of 4 clean-culture crops, 5 small grains, and 6 hay crops at the West Virginia Agricultural Experiment Station, 5 tons of fertilizer raised the total crop yields from 41,000 to 118,000 pounds per acre. But it also greatly increased the organic-matter content of the soil, because of the much greater amount of roots and stubble that were left in and on the soil after the crops had been harvested. The increase in organic matter in the plow depth of soil amounted to 3,600 pounds for each ton of fertilizer applied. If the subsoil had been examined as well, several hundred additional pounds gain in organic matter would certainly have been shown. It seems safe to assume, therefore, that 1 ton of fertilizer, rightly used on land that needs it, can be made to add 2 tons of organic matter to the soil, even when all the crops are harvested and hauled away.

Organic matter is the food of the many billions of soil microbes and of the million or more earthworms that inhabit every acre of good soil. Any practice that will add to the organic-matter supply in a soil will result in an increased number of living things in that soil. Here is where fertilizers and liming materials make one of their most important contributions. By their use much larger amounts of organic food are made available for the life in the soil. The living things in the soil consume organic matter. They do not produce it. It is only the higher plants, which grow above the soil where they have access to the sun, that produce organic matter. In proportion as these higher plants can be made to thrive, to spread their leaves out in the sun so the chlorophyll can get a chance to do its work, more organic matter will be synthesized from air and water.

Fertilizers increase crop yields, and they are needed and used primarily for that purpose. But they are of equal importance for adding organic matter to the soil and for increasing the life in the soil. If land is kept under cultivation con-



Outside appearance of fruit has a great bearing on internal quality.

Whether fruit is grown for fresh markets or cans, adequate care of trees and fruit during summer months determines the quality of the growing crop and health of trees for future crops.

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tinuously, the soil-organic matter will be used up more rapidly than it is replaced by plant roots and crop residues. The answer to this difficutly is best found in taking the land out of cultivation part of the time and putting it into a sod crop. This means crop rotation. In lieu of this, it is necessary to grow cover crops and plow them under or to use animal manures or compost. But neither crop rotation, nor cover crops, nor manure, nor all of them put together will meet the needs for the kinds of quality yields that are required for profitable crop production. They must be supplemented with fertilizers and liming materials.

Farmers' experiences with fertilizers have been so satisfactory for such a long period of time that many land owners have lost sight of some of the other essentials to good soil-management. In fact, fertilizers have been so badly used in so many cases that one would have thought they might have fallen into disrepute. Strangely, however, the only people who object to the use of fertilizers are folks who don't have any very important reason for using them. Propaganda against fertilizers thrives among city folks, who have only a yard or a small flower or vegetable garden at their disposal.

The controversy between the organic gardening city folks and the more practically minded farmers centers around the word "Nature." City farmers claim that fertilizers are contrary to Nature. Yet they are about the most natural things on earth. They come from the earth, and farmers are merely returning them to the earth.

The finest handwork of Nature is man. The Psalmist says:

"What is man that thou art mindful of him, and the son of man that thou visitest him? For thou hast made him a little lower than the angels, and hast crowned him with glory and honor. Thou madest him to have dominion over the works of thy hands, thou hast put all things under his feet, yea, and the beasts of the field, the fowl of the air, the fish of the sea, and whatsoever passes through the paths of the seas."

Of all the living things on earth, man is the only one that is capable of thinking and of acting upon his thoughts in a constructive manner. It is because of this that man is permitted to rule the earth. However badly he may appear to be doing this at times, the fact remains that he dominates his surroundings. After a million years of struggle against the elements, man finally discovered that he could put Nature's stores of phosphate rock, potash salts, nitrate of soda, limestone, and a great variety of other sea-derived substances to work on the land. And he found that he could draw on the atmosphere for additional nitrogen and for the elements that make up the necessary soil-organic matter. By so doing man has made it possible to reclaim worn-out land, to make good land better, and to put new life into all land. The fertilizer industry, one of man's most important contributions to mankind, stands between us and any possible shortages of food for centuries to come.

GRANT FOR CITRUS RESEARCH

A grant of $15,000 has been made to the University of Florida Experiment Stations by Swift & Company for fundamental research at the Citrus Experiment Station at Lake Alfred, Director Willard M. Fifield announced recently.

The grant, accepted by the Experiment Stations, will help to finance research to study the effects of phosphates when formed into compounds with magnesium, manganese, zinc, and other elements in the soil. One of the main objectives of the research will be finding compounds that will not readily leach from the soil, particularly during Florida's summer season of heavy rainfall.

The research will be done at the Citrus Experiment Station and will be under the direction of Dr. A. F. Camp, vice-director in charge, and Dr. I. W. Wander, soils chemist.

Results obtained in the research at Lake Alfred may be applicable to similar soil types in other states, Fifield said.

The grant to the Florida stations is one of 32 awarded by Swift & Company recently to universities, colleges, and other research institutions in this country and Canada. Swift & Company has awarded over $2,000,000 for basic research during the last 10 years, and this is their second grant to the Florida Station within the last two years.

In announcing receipt of the grant, Fifield said, "The Universtiy of Florida Agricultural Experiment Stations are grateful to Swift & Company for this generous grant. It will enable us to make much more rapid progress than otherwise would have been possible in the field of soil research for citrus."

DESERT GRAPEFRUIT ADMINISTRATIVE COMMITTEE IS NAMED

The U. S. Department of Agriculture has named members and alternates of the Administrative Committee to serve under the amended marketing agreement and order program for California-Arizona desert grapefruit, during the fiscal period beginning August 1, 1950.

Members and their alternates are: Max M. Zimmerer, Mecca, Calif. and Leland J. Yost, Thermal, Calif.; Homer C. Poor, Alhambra, Calif. and Theron W. Walker, Indio, Calif.; J. E. Harshman and Louis A. Clarke, Brawely, Calif.; Joe Russo and G. W. Cutshow, Brawley, Calif.; Harry M. Clark and R. M. Hess, Phoenix, Ariz.; W. W. Pickrell and Arthur E. Burgher, Phoenix, Ariz.; Carl E. Hover and Dean H. Thayer, Mesa, Ariz.; Irwin Hearsh, Somerton, Ariz. and Lee Cheshire, Yuma, Ariz.

The Administratice Committee, acting as the official administrative body under the marketing program, makes recommendations, when it is deemed advisable, as to the grades and sizes of desert grapefruit that may be shipped in interstate commerce and to Canada and transmits the recommendations to the Secretary of Agriculture.

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